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Hañka side, they put the mud on the right cheek below the eye. This is the young buffalo-bull decoration. With reference to it, a man says, "My little grandfather (the young buffalo-bull) is always dangerous as he makes an attempt. Very close do I stand, ready to go to the attack!" The horse is painted with some of the mud on the left cheek, shoulder and thigh, if his rider belongs to the Cheezhoo side, but the mud is put on the right cheek, shoulder and thigh of a horse belonging to a warrior on the Hañka side.

Some warriors, who act like a black bear, paint with charcoal alone. (The tradition of the black bear people is, that they brought down fire from one of the upper worlds.)

Some paint in the wind style, some in the lightning style, and others in the panther or catamount style.

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NOTES ON SOME APPARENTLY UNDESCRIBED INFUSORIA FROM PUTRID WATERS.

BY DR. ALFRED C. STOKES.

FROM a dead rat which had been lying exposed to the weather for an unknown period, but long enough to have had most of the abdominal soft parts destroyed, the tail was taken and placed to macerate in ordinary river water as supplied the town by hydrant. By the third day the infusion teemed with minute life, an apparently undescribed Heteromita, which at first glance was mistaken for *H. caudata* Duj., being particularly abundant. A careful examination, however, discovered so many essential points of divergence between it and known forms that it seems to demand recognition as a presumably new species, under the name of *Heteromita putrina* (Figs. 1 and 2).

H. PUTRINA, n. sp.—Body obovate, wider and rounded anteriorly, tapering posteriorly to a somewhat obtuse point; surface smooth, endoplasm enclosing several dark bordered refractive particles; nucleus obscure, apparently centrally placed in the median line; contractile vesicle conspicuous, situated near the right lateral margin of the anterior body half; the vibratile flagellum but slightly exceeding the body in length, the trailing gubernaculum about three times as long as the zoöid, both being of equal size and inserted anteriorly. Length of body $\frac{1}{3000}$ to $\frac{1}{4500}$ inch. Habitat, the putrid water of animal macerations.

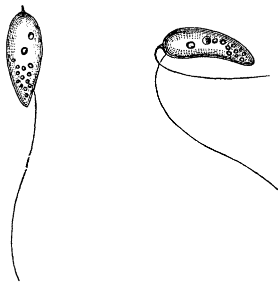

Fig. 1. Fig. 2.

Heteromita putrina, n. sp. × 1500.

The creature, when in a healthy or comfortable condition, is very slightly if at all changeable in shape. When about to die it takes a sub-spheroidal form and becomes diffluent, but this stage is at times postponed until the animal has passed a short period as a granular amœba, with a large and conspicuous contractile vesicle, slowly moving by a forward flow of a sarcode wave unaccompanied by the posteriorly located granules. The motion of the Heteromita when swimming is rapid and oscillating, being a forward movement by short zig-zags, the animal at the same time rotating on its longitudinal axis.

The anterior vibratile flagellum is ordinarily extremely difficult to detect. The zoöid, when attached, rests at the extremity of its anchoring flagellum, and when viewed dorsally the vibrating lash is visible for only the very short distance between its origin and the point where it curves to pass beneath the lower or ventral surface (as in Fig. 1), this part being flexible but apparently not vibratile. Even when in a favorable position for its own demonstration, the rapidly-moving filament becomes visible only after careful manipulation of the mirror, or after the infusorium has been killed by iodine or osmic acid. Small particles are not affected by its motion until they have floated past the anterior margin of the body, sometimes almost in contact with the surface, when they fall into the stream and are dashed upward, at times performing a complete circuit around the animal to the starting point. If solid food is taken, which I doubt, it must enter through the ventral surface. No solid particle has been seen to pass into the endoplasm, although I have tried to feed the creatures with indigo, and have had the same individuals in a growing-slide for four full days surrounded by myriads of bacteria.

The contractile vesicle pulsates quickly and sharply once every nine seconds. The only method of reproduction observed is by longitudinal fission. The species here referred to is remarkable for its stability of form and for the position of its tractellum or vibrating flagellum, the latter peculiarity having been recorded for no other member of the genus.

In the same animal maceration, as the Heteromitæ were disappearing, many ciliated infusoria were developed, which, according to the latest schemes of classification, can be relegated to the genus Tillina only, although, so far as external contour is concerned, the resemblance is remote. This difference of form, however, in connection with certain points of structure, compels its addition to the rapidly increasing list of new American species, while the possession of a pharynx from which spring rows of vibratile cilia, at once forces its admission into the above-mentioned genus.

The likeness of the hitherto single known species, *Tillina magna* Grüber, to Colpoda, has been remarked by its discoverer, but the resemblance between the latter and the form here referred to as *Tillina saprophila*, n. sp., is even more conspicuous than with the type, and would necessarily place it in the genus Colpoda were not the pharyngeal series of cilia present. These cilia are apparently larger but much shorter than those of the general cuticular surface, which are long and very fine. They are with difficulty separately resolved by the objective, unless the infusorium is in a weakened or dying condition; otherwise their motion is incessant, and they themselves become visible only through their effect. They depend from the entire internal surface of the membranous pharynx, projecting slightly, if at all, beyond the oral aperture. The cilia of the general surface are extremely fine and, like those in the pharynx, can be satisfactorily distinguished only when the animal is quiescent, those situated anteriorly then showing themselves to be somewhat the largest. The body is grooved obliquely, the striations being especially distinct on the anterior body half. The circular oral aperture is placed in the center of the ventral surface and, as the infusorium is swimming at ease, appears to be lateral. It is followed by the short membranous pharynx curving toward the posterior extremity of the zoöid and bearing the vibratile series already referred to. The endoplasm, usually colorless, encloses several linear straight or slightly curved dark-bordered bodies, and numerous small corpuscles which at times render the body semi-opaque. The nucleus is large and situated near the center of the dorsal region, commonly opposite, occasionally slightly in advance of the pharynx and oral aperture. The contractile vesicles increase in numbers with the creature's age. In early youth the pulsating vacuole is single and postero-terminal; when the Tillina is mature, or nearly so, two, three or even four, posteriorly placed, are not uncommon. When single, pulsations take place about four times a minute.

Reproduction is accomplished by encystment followed by spore formation and by fission into two or more zoöids, the young in the latter event differing in form so conspicuously from the mature animal that, before the life-history had been traced, they were mistaken for another species and described as such in manuscript. The act is performed without immediate conjugation; whether in the instances observed there had been a remote union, I of course do not know.

Individuals have several times been so accommodating as to enter the field of the objective just before the beginning of the first stage in this reproductive act, thus affording me an opportunity to follow the changes with ease. The body is soft and flexible, but, except immediately prior to encystment, is not changeable in shape. At that time, however, the animal assumes a spherical form, and prepares a cyst so delicate and transparent that ordinarily it is invisible after its evacuation; but occasionally it collapses as an indescribable exuvium containing several bright bubble-like spots, and becomes for a very short time slightly amœboid. Fission is accomplished within this sac, and I have in one or two instances observed a binary division without the formation of an enclosing membrane; but in every case it seems that the divided surfaces become the ventral. The process, at least when four zoöids are the result, consumes about two hours from the assumption of the spherical form. The young force their way from the cyst through a small opening visible only in its effect upon the shape of the emerging creatures. A small knob-like projection first appears, and as the animal urges itself through the aperture, a narrow and sharply defined constriction passes successively over the whole length of the body, each of the little animals emerging through the same opening. The young and the old differ, as shown in lateral view in Figs. 3 and 4, the latter being the mature form, in which the dorsal surface, as seen in profile, is much more strongly and evenly convex, and the ventral more flattened, than in Fig 3. In the infusion, forms intermediate

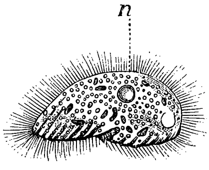

Fig. 3.

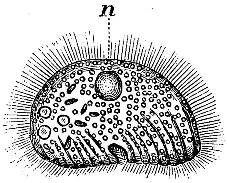

Fig. 4.

Tillina saprophila, n. sp. FIG. 3.—Immature form, × 960. FIG. 4.—Mature infusorium, × 750.

in shape and size are abundant. The length of the zoöid immediately after emergence is $\frac{1}{1000}$ inch, at maturity, $\frac{1}{750}$ inch.

The species seems to be not very susceptible to the deoxygenation of the water, thriving and multiplying where more sensitive infusoria would soon die. But when the supply of oxygen becomes too limited for even its small demands, the second form of reproduction, that of sporular subdivision of the entire body takes place. The zoöid assumes a spherical shape as before, but now prepares a distinct and substantial cyst in which the subdivision is accomplished. I have witnessed the formation of these cysts in very many instances, the completion of the process once only. The cyst wall was then suddenly ruptured and the motionless and finely-divided contents thrown out by the collapsing sac, but to my regret were almost immediately lost amid the surrounding clouds of bacteria.

The movement of the infusorium when first placed on the slide, is rapid and erratic, with rotation on the longitudinal axis; when quieted it is irregularly forward, or in wide circles, usually with one or the other lateral surface downward, thus placing the oral aperture, as already mentioned, apparently upon the side. The following may be taken as a description:

TILLINA SAPROPHILA, n. sp.—Body flexible, obliquely grooved, subreniform or bean-shaped in profile, length once and one-half to twice the width; when viewed dorsally, ovate, wider and somewhat inflated posteriorly, tapering and pointed anteriorly; size and dorsal convexity increasing, the ventral concavity lessening with age, thus giving the mature animal an almost semicircular outline when seen laterally; cuticular surface entirely ciliate, the cilia somewhat larger anteriorly; oral aperture circular, placed centrally in the ventral surface and followed by a short, recurved, membranous pharynx entirely ciliate within; endoplasm enclosing colorless corpuscles and dark-bordered linear bodies; nucleus spherical, dorso-central; contractile vesicles several or single, posteriorly situated; anal aperture not observed. Length of body, $\frac{1}{1000}$ to $\frac{1}{750}$ inch. Habitat, the putrid liquid of animal macerations made with water from the Delaware river.

This species conspicuously differs from *Tillina magna* not only in form and size but in the possession, by the latter, of a posteriorly-developed lobate process, an elongate-ovate anteriorly-placed nucleus, a single contractile vesicle and a larger pharynx.

From an animalcule to a Chinaman is a great leap, and one that mother nature would take longer to make than the writer is at present taking. But Charlie Lee is a genial little Chinaman who now keeps a laundry and sleeps on a shelf, who intends, when he returns to the Flowery Kingdom, to have "a big blick house with tlees in flont." He has started a new "craze" in this town by the introduction of a Chinese narcissus, whose pretty blossoms are brightening many a front window, and perfuming many a room with their delicate fragrance. Charlie's cultivation of the plant is much like our winter culture of the hyacinth, only he thinks it necessary to surround the bulbs with many stones and pebbles, and to bind together the leaves with a strip of red paper, which gives them quite a military aspect. Several of the outer onion-like layers of these bulbs were put to soak, and the result awaited. My pleasure in this result was to be slightly dashed with bitter. The infusion swarmed with what a friend called "heathen dragons," but the dipping-tube occasionally brought up a fragment bearing a sedentary collar-monad, a Monosiga, which, under other circumstances I would have been glad to see. Members of the Choano-Flagellata have become favorites of mine, and I have learned to associate them with especial purity in their surroundings; so to take them from this brownish, mucilaginous and malodorous liquid, was it not the fall that is said to always follow undue pride? This alone, however, would scarcely have upset my equilibrium. There is a little more. The creature was one that had seemed particularly graceful, and I had described it as new in the *American Monthly Microscopical Journal* for Nov., 1883, naming it *Monosiga Woodiæ*, after a friend. How did it get into this undesirable predicament? Had its quiescent germ been clinging to the bulb from China land? Had it been swinging in the air of Trenton, or had it been floating in the water of the Delaware? Who can tell?

With it *Goniomonas truncata* Fres., whose habitat is said to be "fresh water," was present in profusion, its numbers increasing rapidly by longitudinal fission, and a Tillina, differing so markedly from the form in the rat-tail maceration that it must be regarded as a new comer among known infusoria.

The latter Holotrichous creature, represented in Fig. 5, is so peculiar in form that I hardly know how to characterize it except by saying that it is somewhat mitten-shaped, although its resemblance to that ugly hand-protector is rather distant. Neither kidney nor bean ever possessed that posterior enlargement which gives the animal its curious mitten-like contour, and which makes *inflata* a suitable

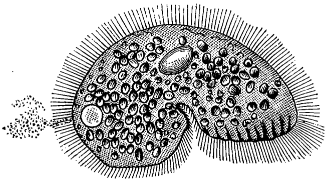

FIG. 5.—*Tillina inflata*, n. sp., × 560.

specific name. When viewed dorsally, consequently in transverse optical section, the body is ovate in outline. In its lateral aspect, as is shown in the figure, it exhibits a superficial differentiation into an anterior narrower body-half and a rounded, very conspicuously widened and inflated posterior portion. When mature it measures $\frac{1}{486}$ inch in length, $\frac{1}{750}$ in. at the widest part of the posterior body half, and $\frac{1}{1000}$ in. at the greatest width of the anterior portion.

The surface is obliquely grooved, apparently in two directions, this double striation being much more conspicuous in the young, as is also the case with *Tillina saprophila.* In color it is a deep amber. The tint varies in depth, however, changing with the color of the infusion and, to a certain extent, with age, the young usually being paler than the adults. The granulate endoplasm encloses many large granular corpuscles, seemingly formed of agglomerated food particles, almost as abundant in those just escaped from the cyst as in the older animals. The large ovate nucleus is located above the median line near the center of the dorsum. The single contractile vesicle is situated close to the posterior extremity and to the right. It pulsates, as in the preceding species of the genus, once each fifteen seconds. The anal aperture seems to be rather indifferently placed either above or below the pulsating vacuole. But I may have misinterpreted this, as its appearance is always sudden and unexpected, the animal being in rapid movement at the same time, and the contractile vesicle probably collapsed and invisible. The ovate oral aperture is placed obliquely near the center of the left lateral margin of the ventral surface. The succeeding rather capacious but short and slightly recurved pharynx is entirely ciliated, the cilia being of course shorter, but apparently much coarser, than the long fine vibratile hairs of the cuticular surface. To actually see the individual pharyngeal cilia is no small matter, demanding no slight amount of patience even after the restless creature has been cornered; their seemingly greater size may therefore be illusory both with this and the preceding Tillina, as I have in no instance been able to see them in the recently-killed infusorium, while those of the cuticle are then readily resolved.

Its movements resemble those of *T. saprophila,* the creature floating upon one side, usually the left, when quietly feeding on the bacteria that seem to be a favorite food. When these plants are abundant they are swept through the pharynx and into the body in a strong stream, the animal having sufficient intelligence to know and to reject what may be unpleasant or non-beneficial. With indigo it refuses to have anything to do; and a particle of any kind that may be too large, or otherwise unacceptable, scarcely passes the oral aperture before the current is reversed and the disagreeable substance dashed out.

Reproduction with the form referred to as *Tillina inflata*, n. sp., is accomplished, so far as I have observed, by encystment and subdivision of the body into four zoöids, which differ from the adult in no particular, except in their smaller size.

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COLONIAL ORGANISMS.

BY CHARLES MORRIS.

THE remarkable resemblance which appears between the separate segments of an Annelid, the distinct units of a Hydrozoan, or in the sectional parts of other forms of the animal and vegetable kingdoms, is one that admits of two interpretations, and has in consequence given rise to two opposed theories. In the first, supported by several eminent scientists, it is assumed that each unit or segment represents an original individual, and that the existing individual arose through the subordination of the members of an original colony. In the second, supported by equally eminent authorities, it is assumed that the organs of an original individual gradually took on the form and functions of the parent body, and thus, though originally diverse in function, grew to closely resemble each other.

This latter theory, which is based on the assumed tendency of each cell or other portion of an organic form to develop into an exact reproduction of that form, is supported by Huxley, Van Beneden and other biologists. The opposite theory, which is based on the apparently direct indication of the facts, is sustained by Allman, Gegenbaur, Claus, Lankester, the Hertwigs, &c. Late discoveries seem to sustain the colonial rather than the individual theory. The probable fact is, however, that they are both, to a certain extent, true, and that both the colonizing habit and the reproductive power of single cells have had their share in the formation of the closely similar sections of Hydrozoan and Annelidan individuals.